COMPLIMENTS OF THE
DEPARTMENT OF PLANT PATHOLOGY

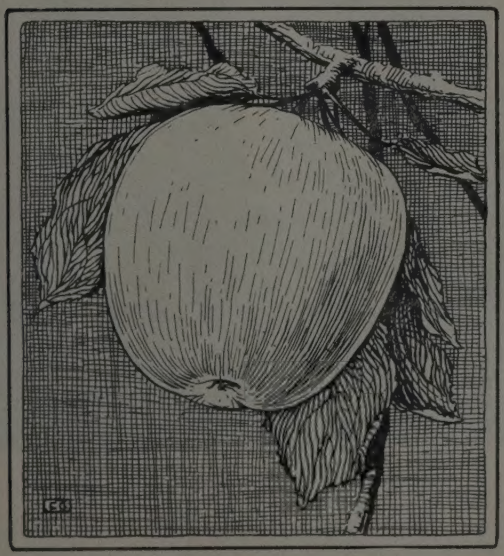
May, 1916 Extension Bulletin 1

Cornell Extension Bulletin

Published by the New York State College of Agriculture
at Cornell University, Ithaca, New York

Protecting the Home Apple Orchard by Dusting

Donald Reddick and C. R. Crosby



Published and distributed in furtherance of the purposes provided for in the
Act of Congress of May 8, 1914

PROTECTING THE HOME APPLE ORCHARD BY DUSTING

DONALD REDDICK AND C. R. CROSBY

Statistics obtained in various ways show that only a relatively small proportion of the bearing apple trees in New York State are ever sprayed, either in winter or in summer, for protection against diseases and the

FIG. 1. ORCHARD DUSTER IN OPERATION

depredations of insects. This means that there are more bearing apple trees in the home orchards of the State than there are in the extensive commercial orchards, for which New York is justly famous. Since a large number of trees continue to live in these neglected orchards in spite of the San José scale and the tent caterpillar, and since these trees are capable of bearing large crops of fruit, an easy method of protecting foliage and fruit from diseases and insects should be of great value to owners of small orchards.

The method proposed consists essentially in combining a fungicide (sulfur) and an insecticide (powdered lead arsenate) in a finely powdered state and in blowing the mixture over the trees at the proper time, instead of in using the same materials in water and applying them as a spray.

Numerous reasons have been assigned by owners of small home orchards for not spraying, some of which may be enumerated: (1) Too much trouble. This usually means not enough experience with high pressure pumps, gasoline engines, and the art of spraying. (2) Too expensive. A power outfit is expensive, and one is scarcely justified in owning a power outfit for a few acres of orchard. (3) Hard, dirty work. This is very true, especially if the work must be done with a hand outfit. (4) Too busy. Spraying conflicts with spring plowing and all the spring operations on a general farm.

Perhaps any one of the objections offered is sufficient reason for not spraying, but the most valid ones are the first and the fourth, namely, too much trouble and too busy with other necessary work. The method herein suggested should therefore appeal very strongly to the owners of small orchards, since the work can be done quickly, with little trouble, and without interfering to any great extent with other farm work. Furthermore, the investment in machinery is not great.

FIG. 2. FULL-GROWN CODLING MOTH CATERPILLAR IN ITS BURROW IN AN APPLE

To prevent injury by this insect the trees should be dusted with a mixture containing arsenate of lead just as the last of the petals are falling

By the dust method it is possible to prevent damage to fruit and foliage from the apple scab (Fig. 3) and the sooty blotch diseases and from most of the orchard insects that chew. The most destructive of these insects are codling moth, or apple worm (Fig. 2), and tent caterpillars.

The dusting method has been under trial in an experimental way for five years in various New York orchards. Accurate records have been kept of the comparative efficiency of dusting and spraying when tried on large blocks of trees in the same orchards. In all of the trials there has been an additional block of trees left untreated for comparison. In some years the fruit even in untreated blocks has been practically free from blemish, and in such cases the experiments have given inconclusive results. In other years or in different parts of the State the amount of scab has been low and the injury by codling moth high or vice versa; therefore the figures in the following tables are selected from a large number of experiments because they show extreme conditions and furnish a severe test of the proposed method. The results of dusting on the control of scab

and codling moth only are shown in the table, because these are annual troubles most likely to cause serious loss.[1]

Two good tests of the value of dust for killing tent caterpillars have been made. These were in 1913 and in 1914 in Tioga County. In each case the dry material was applied before the blossoms opened. In one plat in the same orchard, an application of dust after the blossoms fell

FIG. 3. APPLE SCAB DISEASE
The disease can be controlled by the timely application of powdered sulfur

was effective in killing the caterpillars, but they had already done considerable damage.

The relative effectiveness of spraying and dusting for apple scab and for codling moth is shown in the accompanying tables. In nearly every case the percentage of scab on dusted apples is a little higher than on sprayed ones. This is accounted for by the fact that the particles of

[1] Any one interested in details of the experiments or in a more extended discussion of the methods employed should consult the following bulletins of the Cornell University Agricultural Experiment Station:
Bulletin 340. Experiments in the dusting and spraying of apples. By F. M. Blodgett.
Bulletin 354. Further experiments in the dusting and spraying of apples. By Donald Reddick and C. R. Crosby.
Bulletin 369. Dusting and spraying experiments with apples. By Donald Reddick and C. R. Crosby.

sulfur are not so fine in the dust as when they come from the solution and therefore do not stick to the fruit so long. An additional application of dust must be made if the last trace of scab is to be held in check. However, the figures do not show the true condition without a word of explanation.

TABLE 1. COMPARATIVE TESTS TO SHOW THE RELATIVE VALUE OF SPRAYING AND DUSTING FOR THE CONTROL OF THE APPLE SCAB DISEASE

Variety	Year	Percentage of apples infected with scab		
		Untreated trees	Sprayed trees	Dusted trees
Rhode Island Greening	1912	9.	.7	.1
Rhode Island Greening	1913	80.	21.	33.
Baldwin	1914	34.	7.	4.
Maiden Blush	1915	22.	1.	1.
Rhode Island Greening	1915	78.	1.	7.
Baldwin	1915	17.	2.	1.

TABLE 2. COMPARATIVE TESTS WHICH SHOW THE RELATIVE VALUE OF SPRAYING AND DUSTING FOR THE CONTROL OF CODLING MOTH

Variety	Year	Percentage of apples infected by codling moth		
		Untreated trees	Sprayed trees	Dusted trees
Rhode Island Greening	1912	37.	6.	1.
Rhode Island Greening	1913	12.	1.4	.4
Tompkins King	1913	20.	7.	4.
Baldwin	1915	29.	11.	5.
Baldwin	1915	16.	8.	3.
Rhode Island Greening	1915	16.	3.	2.
Twenty Ounce	1915	16.	8.	3.

In almost every case the scab spots on the dusted apples appeared late in the season and for the most part were very small. They were not a noticeable injury to the fruit, and most of the apples were packed as

"A" grade (first class) fruit. For home use or for home storage the spots were too small to be of any consequence.

In every case arsenate of lead was applied more effectively as a dust than as a spray for the control of codling moth, according to table 2. Other insects, such as bud moth and curculio, were also controlled by the dry method.

The two tables indicate clearly that the dusting method is effective in New York orchards. The time and labor required and the expense of dusting are the next questions that naturally arise.

TIME AND LABOR

In all the experiments mentioned an accurate record has been kept of the time required to make the treatments. There has been considerable variation in the relative time required to spray a tree and to dust one. The variation, however, has been due largely to the difference in equipment for spraying trees in the various orchards. In some cases dusting has been four times as rapid as spraying, and in others ten times as rapid. In all cases, however, the spraying has been done by experienced men who have had large power spraying outfits. There are no comparisons with hand power spraying available. There were usually three men and a team for the spraying outfit and two men and a team for the duster. Stated concretely this means that two men and a team can accomplish as much in one day in treating an orchard with a dust preparation as three men and a team could do in from four to ten days in treating the same orchard with a spray.

COST OF MATERIALS

The cost of material for making one application of spray on one tree has been averaged for eight of the orchards in which experiments have been performed and is found to be 4.3 cents. The cost of dusting trees cannot be determined accurately, because the dusting method has not been fully commercialized, but estimating from the price of materials as now offered in bulk the cost for dusting a tree once would average from 7 to 10 cents. This is on the basis of applying each time 2 pounds per tree of a mixture containing 85 per cent sulfur and 15 per cent lead arsenate. The difference is considerable but is more than offset by the time saved and by the possibility of making the applications on exactly the days that they will do the most good.

WHAT MATERIALS TO APPLY

In all of the experiments a very finely ground flour sulfur and a finely powdered arsenate of lead have been used.

The sulfur is so fine that at least 95 per cent will pass a sieve having 200 meshes to the inch. This is much finer than ordinary ground brimstone and much finer than flowers of sulfur. If ground crude sulfur having this same degree of fineness can be obtained, it may be used with safety and at considerable saving in expense. Powdered arsenate of lead can be obtained from dealers in almost all parts of the State or from numerous large chemical houses. For those who have a small orchard it may prove more convenient to buy a dusting mixture already prepared. In buying such a mixture the grower should insist on having the sulfur in the exceedingly fine condition. At least 95 per cent of the sulfur should pass a sieve having 200 meshes to the inch. The mixture should contain 85 per cent fine sulfur and 15 per cent powdered arsenate of lead.

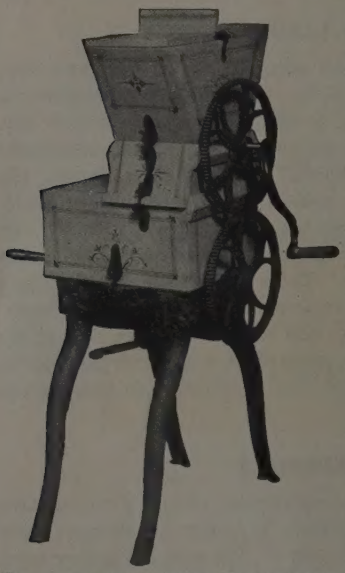


FIG. 4. COMBINED SIFTER AND MIXER FOR HOME MIXING OF DUSTING MATERIALS

HOME MIXING OF MATERIAL

In cases where several hundred pounds of the mixture are needed a saving may be effected by mixing the materials at home. A suitable mixing machine is necessary for the work (Fig. 4). The following extract from a letter states clearly the method employed by large orchardists in the preparation of material:

"I think I told you when I saw you Friday afternoon that I was very much pleased with the operation of the small mixer. As a matter of fact nothing could have been nicer or worked more satisfactorily. The machine holds fifty pounds when completely full, but the growers found the most satisfactory way of operating was to use but twenty-five pounds for a charge. This called for three pails for weighing out the material, two for sulfur and one for lead. The first pail of sulfur was dumped into the hopper, then the lead, and then a second pail of sulfur was added. By the time the pails had been refilled with sulfur and lead the charge of material previously put in the machine was thoroughly mixed and the material ready to be discharged. Operating in this way it took five minutes to the charge, and we found, as a result of three or four hours'

work, that the machine will actually turn out an average of 300 pounds of mixture per hour. As ready-to-use mixtures are sold at an advance of from 2 to 4 cents per pound over the cost of materials, you can see that at the above rate of operation, even at 2 cents per pound advance, the machine would pay for itself twice over in a day."

The mixture may be prepared ahead of time and stored in a dry place in bags or barrels, or it may be made up as needed. With home mixing it is possible to vary the quantity of the ingredients used. If scab is not a serious trouble, as it often is not on such varieties as Tompkins King or in such regions as parts of the Hudson Valley, thirty or forty pounds of the sulfur may be replaced by hydrated lime or by finely powdered gypsum, all of which will pass a sieve of 200 meshes to the inch.

FIG. 5. COMMERCIAL ORCHARD DUSTING

The dust is applied by long sweeps of the outlet pipe. The team walks at a brisk pace, and the dust is distributed on one side of the row at a time. The trees shown here are very large

APPLYING THE MIXTURE

The dust mixture is applied with an outfit which depends on a rotary fan to furnish an air current and which is provided with a hopper and feeding device to drop the mixture slowly into the air tube. The motive power may be hand or engine.

For small orchards a hand power machine will prove satisfactory. It may be placed in the back of a platform wagon, and one man and a boy with a horse are sufficient to operate it. If there are many trees to treat, it would be better to have an outfit that can be operated by a small gasoline engine. The mixture is applied by driving slowly back and forth on each side of every row, distributing the dust by long up and down sweeps of the outlet pipe. By weighing out a known quantity

FIG. 6. TRACTION DUSTER
The horse traction outfit shown here is designed for vineyard work, but it might be adapted to orchard work where the trees are not too tall

FIG. 7. HAND DUSTER
A hand duster of this size is convenient for treating small trees and bushes about the house

of the mixture at the start, the operator will soon learn how fast to drive in order to distribute an average of from $1\frac{1}{4}$ to $2\frac{1}{2}$ pounds per tree each time. It is likely that in most cases the horse can be driven at a moderate pace, and one may be sure that the outfit is not working properly if it is necessary to stop at a tree.

WHEN TO APPLY THE MIXTURE

The secret of obtaining apples free from disease or insect injury lies in the timeliness of application of the material. This is true regardless

FIG. 8. HAND DUSTER
This hand machine is adapted to the needs of the dooryard horticulturist

of the material used. It has been found from experience over a number of years that there are at least four times when a treatment may prove of value. These times are:

1. When the blossom buds show pink.
2. Just as soon as the blossoms have fallen; this is the important application for codling moth and should never be omitted.
3. Three weeks after the second treatment.
4. Ten weeks after the second treatment.

In order to best control apple scab the mixture should be on the trees before prolonged periods of rain and fog. It has been found that rain

does not wash much of the material from the trees, and in some cases dust has been applied in mist and fog. A very favorable time for applying the mixture is on a calm morning while dew is still on the trees. Under such conditions the dust can be applied very rapidly and very thoroughly.

GENERAL SUMMARY

In order to obtain good results with dusting use a mixture containing 85 per cent of exceedingly fine sulfur and 15 per cent of equally finely powdered arsenate of lead. Make the applications from both sides of the trees, applying from $1\frac{1}{4}$ to $2\frac{1}{2}$ pounds of the mixture per tree each time. Make at least the first three applications of dust, and in rainy seasons make four or five.

SOURCE OF SUPPLIES

Manufacturers of machinery and supplies for dusting, so far as known to the writers, are here enumerated in alphabetical order. In some cases, particularly of dealers in powdered arsenate of lead, the list is doubtless incomplete.

DUSTERS

Corona Chemical Company,
Milwaukee, Wisconsin.
Small hand machine, not suitable for use on wagon.

Kansas City Dust Sprayer Manufacturing Company,
W. L. Terhune, General Eastern Agent,
Waterville, New York.
Gasoline, horse, and hand power machines.

Leggett and Brother,
301 Pearl Street,
New York City.
Horse traction and hand machines.

Niagara Sprayer Company,
Middleport, New York.
Gasoline and horse power machines.

Tow-Lemons Manufacturing Company,
Springfield, Tennessee.
Small hand machine, not suitable for use on wagon.

DUSTING MIXTURE

Corona Chemical Company,
Milwaukee, Wisconsin.

Kil-Tone Company,
Malvern Street,
Newark, New Jersey.

Niagara Sprayer Company,
Middleport, New York.

B. G. Pratt Company,
50 Church Street,
New York City.

W. L. Terhune,
Waterville, New York.

Vreeland Chemical Company,
50 Church Street,
New York City.

DUSTING SULFUR

Niagara Sprayer Company,
Middleport, New York.

W. L. Terhune,
Waterville, New York.

POWDERED LEAD ARSENATE

Corona Chemical Company,
Milwaukee, Wisconsin.

Grasselli Chemical Company,
Cleveland, Ohio.

Hemingway & Company,
Bound Brook, New Jersey.

Interstate Chemical Company,
12 Bayview Avenue,
Jersey City, New Jersey.

Kil-Tone Company,
Malvern Street,
Newark, New Jersey.

B. G. Pratt Company,
50 Church Street,
New York City.

Riches-Piver Company,
30 Church Street,
New York City.

Sherwin-Williams Company,
601 Canal Road,
Cleveland, Ohio.

Thomsen Chemical Company,
Baltimore, Maryland.

Vreeland Chemical Company,
50 Church Street,
New York City.